

#### **AGENCY OF TRANSPORTATION**

FY 2020 Municipal Highway Grant Application	
APPLYING FOR: Structures Class 2 Roadway Emergency	
MUNICIPALITY: Richmond MUNICIPAL CONTACT (name): Peter Gosselin	
MAILING ADDRESS: PO Box 285 Richmond VT 05477	
Phone: (802) 434-2631 E-Mail: richmondhighway@gmavt.net	
ACCOUNTING SYSTEM:	
DUNS #: 019336999 Grantee FY End Month (mm format): 06	
DISTRICT CONTACT (name): Ashley Bishop  Phone: (802) 655-1580	
Location of Work. The work described below involves the following town highway / structure:  TH# 14 , (Name) Stage Road	
Causeway:	
Latitude: 44.39 Longitude: 72.93 MM (If Available):	
Problem:	
Culvert is deteriorated and too short for the crossing. The hydraulic study concludes the culvert is undersized. Guardrails are tipping out from the road due to lack of shoulder. The center of culvert is bowed and showing signs of collapse.	d
Reason For Problem:	
Aged and undersized drainage crossing culvert.	
Proposed Scope of Work: Replace 60"x40' road crossing culvert to a 140"x70"x60' corrugated metal arch pipe with poured in place concrete headwalls. Install new guardrails.	
Detailed Cost Estimate (below or attached):	
See attached	
Estimated Project Amount: \$ 224,595 Estimated Completion Date: 11/01/2020	

Municipality has complied with 19V.S.A. Section 309(d) regarding "complete streets."			NO
Municipality has adopted Codes & Standards that meet or exceed the State approved template?		<b>✓</b> YES	NO
Municipality has a current Network Inventory? (less than 3 years old)		<b>✓</b> YES	NO
Municipality MUST complete the following environments	nmental resource checklist:		
EXISTING STRUCTURES: (check all that apply	·)		
✓ Steel Tube Culvert	Concrete Box Culvert	* (manuse & decre	
Stone Culvert	Concrete Bridge		
Ditch	Rolled Beam/Plate Girder Brid	ge	
Metal Truss Bridge	Wooden Covered Bridge		well-fit to will I control the self-finished to a
There are foundation remains, mill ruins, stone walls or other	Masonry Structure		
Stone Abutments or Piers	Buildings (over 50 yrs old) within 30	00 feet of w	ork
Other:		The States Advisor Control and a second and a second above and a second as a second as a second as a second as	
PROJECT DESCRIPTION: (check all that apply)			<del>*************************************</del>
The project involves engineering / planning only	The project consists of repaving of paved surfaces only	existing	***************************************
The project consists of reestablishing existing ditches only within existing footprint	All work will be done from the e shoulder	xisting roa	ıd or
✓ The structure is being replaced on existing location / alignment	There will be excavation within 3 river or stream	300 feet of	`a
New structure on new alignment	Repair/Rehab of existing structure		
There will be excavation within a flood plain	Road reclaiming, reconstruction	n, or wide	ning
Tree cutting / clearing	✓ Temporary off-road access is requested.	uired	
New ditches will be established	The roadway will be realigned		
The municipality has included photos of the project. Must show infrastructure and surrounding features as much as possible.			
Below this line to be filled in by VTrans staff:  Recommended Award Amount:  District Staff Approval: (name)	Date:		

# TOWN HIGHWAY STRUCTURES FY 20 GRANT REQUEST

**Location:** Stage Road TH 14 (culvert #1410)

#### **Description of existing structure:**

The road crossing is 60 inch by 40 foot long corrugated asphalt coated metal culvert. The pipe has laid up stone for headwalls on the inlet and outlet ends. The inlet end of the pipe has a 20 foot high Hemlock tree growing out of the headwall. The slope on the inlet and outlet ends of the culvert are vertical approximately 90 degrees. The guardrails are sloping away from the culvert due to lack of shoulder.

#### Scope of work:

Replace existing 60" x 40' diameter drainage pipe with a 140" x 70" x 60' polymer coated corrugated metal arch pipe. Install poured in place concrete headwalls on both the inlet and outlet ends of the culvert. Remove and replace existing guardrails. Install detour sign package. Road closure should be approximately 10 days. Road reduced to one lane after culvert is installed for 2 weeks.

#### Item:

lump sum	5000
•	5000
•	100000
200' @\$	30.00 6000
60' @\$	262.00 15720
520.00	1040
8 x 495.00	3960
lump sum	600
200 ton @ \$	12.50 2500
50 ton @ \$	16.50 825
200 ton @ \$	10.00 2000
150 ton @ \$	13.00 1950
lump sum	10,000
40 hours @ \$1	100.00 4000
lump sum	3000
lump sum	25000
lump sum	25000
lump sum	3000
lump sum	<u>10000</u>
	60' @ \$ 520.00 8 x 495.00 lump sum 200 ton @ \$ 50 ton @ \$ 150 ton @ \$ lump sum 40 hours @ \$1 lump sum lump sum lump sum

Project total \$224,595

Maximum allowable project state grant funding \$175,000

State 80% match \$175,000

Town 20% match \$49,595 submitted by: Peter Gosselin 4-5-19



March 23, 2018

Town of Richmond Attn: Pete Gosselin, Road Foreman 203 Bridge Street Richmond, VT 05477

RE:

Hydraulic Study – Stage Road (TH14)

GPS Coordinates: 44.39374 N / -72.93248W

Waterbody: Unnamed tributary to the Winooski River

## **Project Understanding**

East Engineering has completed a preliminary hydraulic study for the above referenced site and has summarized details of the study in subsequent sections of this letter. A site visit was conducted on March 21, 2018 to visually inspect the stream, road, and culvert conditions. Due to heavy snowpack and ice conditions, approximate measurements were completed for the road, stream, and culvert. Measurements should be refined/confirmed, and this study revised (if necessary), once the site clears of snow/ice.

## **Hydrology**

This site consists of a hilly/mountainous drainage basin, is primarily wooded with steep grades, and is located in a rural setting. Near the road crossing, the stream channel slope averages approximately 7%, however, there is a mix of areas that have plunges (steeper than 7%) and sections that meander (shallower than 7%). The area immediately upstream and downstream of the culvert (approximately 50' either direction) have a channel slope of approximately 2-4%. The total drainage area upstream of the culvert inlet is approximately 0.95 mi<sup>2</sup>.

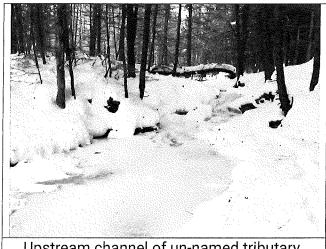
The following design flow rates were obtained from USGS StreamStats:

Recurrence	Flow Rate in Cubic Feet Per
Interval (Years)	Second (CFS)
Q2	53
Q10	114
Q25	154 (Local Road Design)
Q50	190
Q100	229 (Check Flow)



### Channel Morphology

This stream channel is steep and consists of large boulders, ledge outcroppings and plunge pools. Both inlet and outlet banks are steep and wooded. The bank full width varies and ranges from 8-12 feet, with several larger pool areas (depending on boulder/ledge locations) and several narrow channel locations. The depth of the stream varies and is shallow at some of the drops and has several pools that are several feet deep. The culvert inlet sits in a topographic



Upstream channel of un-named tributary.

depression, which has collected debris during higher flow events. The outlet channel appears to be slightly scoured due to higher velocities caused by the undersized culvert. The outlet channel generally parallels Stage Road in the vicinity of the project.

# **Existing Conditions**

The existing structure is a 5' diameter corrugated metal pipe culvert, which is both galvanized and tar coated, providing approximately 20 ft<sup>2</sup> of waterway opening. The top half of the culvert appears to be in fair condition, given the age, however, the bottom portion of the culvert has lost all galvanized and tar coatings and shows signs of corrosion and deterioration. The inlet headwall of the culvert is stacked stone, which is in poor condition and is deteriorating. Due to the grade difference between



5' diameter CMP inlet and road embankment.

the road and the stream, both the inlet and outlet slopes above the headwalls are very steep and show signs of erosion.

The structure is not in compliance with the VTrans Hydraulic Manual, does not meet bankfull width requirements, and restricts aquatic organism passage (AOP). Hydraulic calculations for the existing culvert were completed using HY-8 Culvert Hydraulic Analysis Program, published by the US Department of Transportation, Federal Highway



Administration. Results show that headwater depths do not overtop the roadway, however, are not in accordance with the VTrans Hydraulic Manual. Headwater depths of 5.7' at Q100 and 4.2' at Q25 were calculated.

# Replacement Recommendations

The span, geometry, and installation method of the replacement structure should meet several criteria, including:

- Vermont Stream Alteration General Permit
- VTrans Hydraulic Manual Standards

Based on the preliminary sizing information, the following structures should be considered. Minimum requirements include a 11' clear span and 44 ft<sup>2</sup> of waterway opening. The structure criteria should be further evaluated during final design to ensure compatibility with site conditions.

- 1. Metal Pipe Arch (Galvanized Steel or Aluminum): Exact structure dimensions vary by manufacturer, however, a structure with approximate dimensions of 11'-8"x5'-9" will provide the required waterway opening and minimum span. Pipe arches are manufactured with both closed bottoms and open bottoms. Open bottom is preferred, however, if a closed bottom is utilized, sills should be spaced at 8' increments and be "V" shaped (12" at sides, 8" in middle). Natural stream gravel or a clean (no fines) cobble/stone product should be added between sills. Concrete footers/pedestals/headwalls will be required to complete the structure installation. This structure will result in headwater depths of approximately 3.3' at Q25 and 4.8' at Q100 with no roadway overtopping.
- 2. Precast Concrete Box Culvert: The structure should have an 11' span and 6' high (inside opening). The box invert should be buried approximately 2' below natural stream channel elevations, which would result in an opening of 11'x4' (44 ft²). The box culvert should have sills spaced at 8' intervals and be "V" shaped (12" at sides, 8" in middle). The precast concrete box will require headwalls, wingwalls, and cutoff walls for a complete installation. This structure will result in headwater depths of approximately 2.5' at Q25 and 3.4' at Q100.
- 3. Any similar structure that meets the minimum requirements of this analysis and the site conditions.

#### **General Comments**

Regardless of the selected replacement structure, several common items should be implemented.

1. If a closed structure (4-sided concrete box, or pipe arch) are used, the inverts should be buried to a level of 2' below natural channel elevation.

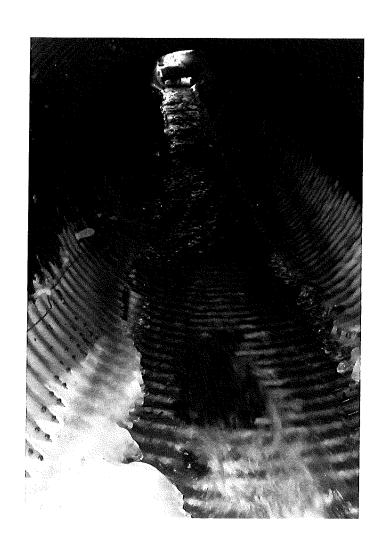


- 2. The wingwalls and cutoff walls should extend 4' below the invert of the streambed, or to ledge, to prevent undermining of the structure.
- 3. Wingwalls should be used to transition from the road grade to the stream banks. Properly sized wingwalls will mitigate road bank erosion issues and also provide additional protection from stream undermining/scouring.
- 4. Type III stone should be used to armor/anchor the transition from the wingwalls to the surrounding ground and for the culvert inlet/outlet.
- 5. Both US Army Corps of Engineers and Vermont Agency of Natural Resources Stream Alteration should be contacted during the design phase to ensure the proposed project complies with applicable permitting standards.
- Metal pipe arches have specific requirements regarding backfill and cover between top of structure and roadway elevation. The site should be able to provide adequate cover; however, this should be evaluated during final design.
- 7. As previously noted, due to snowpack/ice, approximate dimensions were obtained for the hydraulic calculations. Prior to final design, field dimensions should be confirmed, and design flows calibrated.

Please let me know if there are any questions or you need any additional information.

Sincerely,

Tyler Billingsley, P.E. Engineer / Owner



STAGE ROAD CULVERT # 1410